

I claim:

1. A method for monitoring an analog meter having a set of graduation segments and at least one needle, the method comprising the steps of:

- recording a digitized image of the meter;
- extracting a set of edge points, the points representing the graduation segments;
- performing a Hough Transform on the set of edge points so as to obtain a center point of the graduation segments; and
- extracting an intensity profile of the image along a path through the graduation segments so as to obtain a set of detected graduation segments and a position of the needle relative to the graduation segments.

2. The method according to claim 1, further comprising the steps of:

- obtaining a parameter representative of needle position accuracy;
- recording a second digitized image of the meter;
- obtaining a position of the needle without performing a Hough Transform so as to obtain a position of a center point when the parameter meets a predefined condition; and
- performing the Hough Transform so as to obtain the center point when the parameter does not meet the predefined condition.

3. The method according to claim 2, wherein a number of discreet contiguous angles are obtained for the parameter when an intensity profile is below a threshold intensity.

4. The method according to claim 1, wherein the step of performing a Hough Transform further comprises the steps of:

- for a subset of graduation segments, obtaining a corresponding candidate segment orthogonal to an edge gradient, of an edge point of each of the graduation segments, whereby the candidate segment is located a predefined distance from the edge point of the graduation segments;
- obtaining an extreme value of the distribution of the candidate segment of the subset;
- obtaining a centroid of the extreme value.

5. The method according to claim 1, further comprising the step of:

- extracting at least one set of local minimum intensity values from the intensity profile by applying a deep pocket criterion and selecting a set of local extreme values comprising a number of the extreme values with a predefined range.

6. The method according to claim 2, wherein the step of obtaining a position of the needle further comprises the steps of:

- defining a range of radii each with respect to the center point;
- obtaining at least one angle where the intensity of the image within the range of radii meets a predefined condition.

7. The method according to claim 5, further comprising the step of:

- obtaining at least two sets of local extreme values from the intensity profile at different radii, each

radii with respect to the center point, and merging sets of local extreme values having similar angles.

8. The method according to claim 1, further comprising the steps of:
 - obtaining a set of edge points in a predefined area surrounding the center point;
 - performing a Hough Transform on the set of edge points in a predefined area;
 - 10 - obtaining a pivot center of the needle; and
 - projecting the detected position of the needle to a plane of a graduation scale.
- 15 9. The method according to claim 1, further comprising the step of:
 - comparing the positioning of the needle to the detected graduation segments so as to obtain a digital value for a display status of the meter;
 - comparing the digital value to a preset value; and
 - 20 - transmitting a message to a control station via a communication network.
- 25 10. An apparatus for monitoring an analog meter, comprising:
 - a sensor for obtaining a digitized image;
 - 25 - a data processor for:
 - extracting a set of edge points from the image wherein the edge points represent graduation segments of the meter,
 - performing a Hough Transform on the set of edge points to obtain a center point,
 - 30 - extracting an intensity profile of the image along a path through the graduation segments;
 - obtaining a position of the needle relative to the set of detected graduation segments; and

27

an interface device for communicating with a communication network data generated by the data processor.

2001-02-01 15:47:20